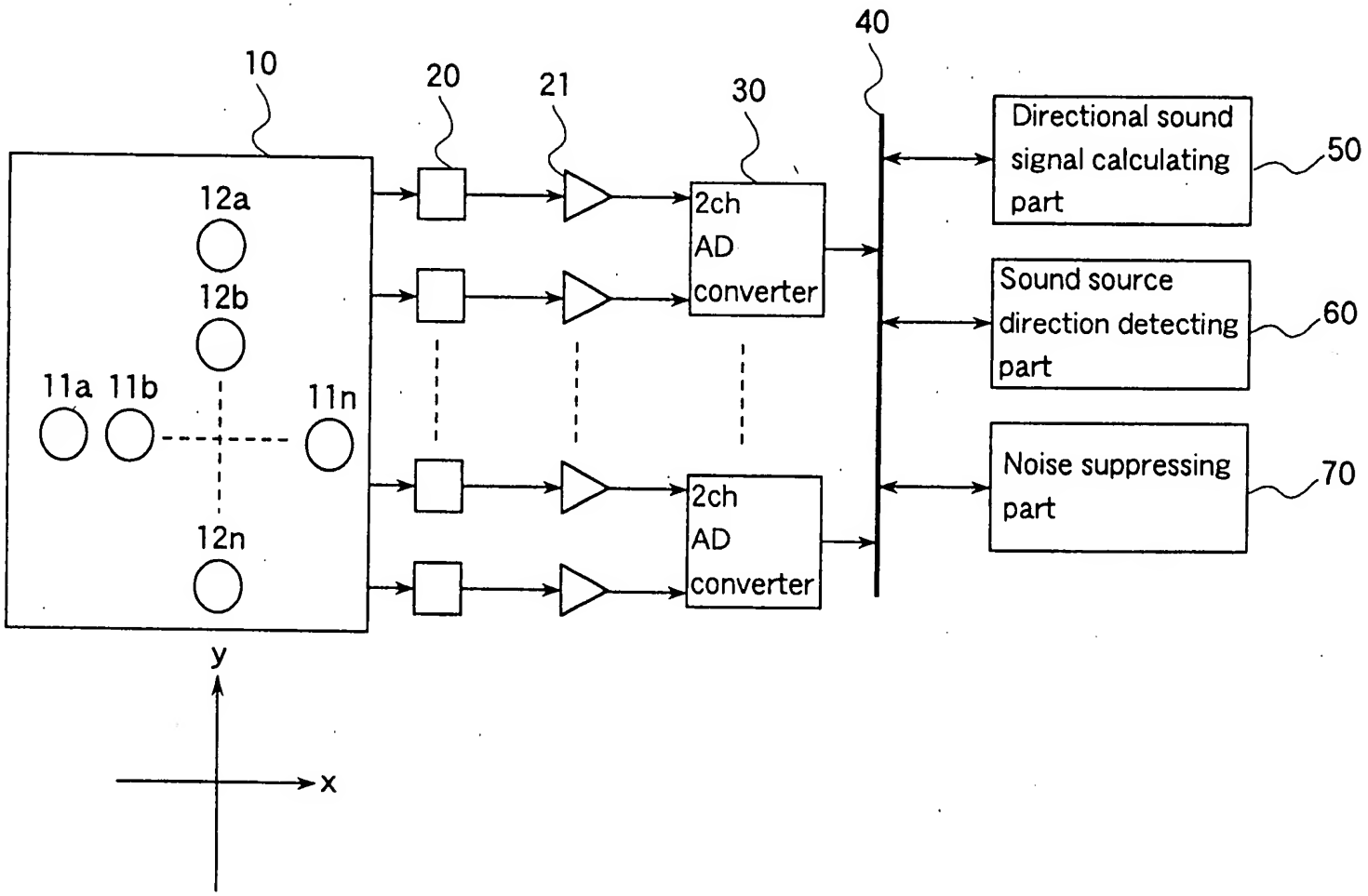

10
20
21
30
40
12a
12b
11a
11b
11n
12n
2ch
AD
converter
2ch
AD
converter
Directional sound signal calculating part
50
Sound source direction detecting part
60
Noise suppressing part
70
y
x

FIG. 1

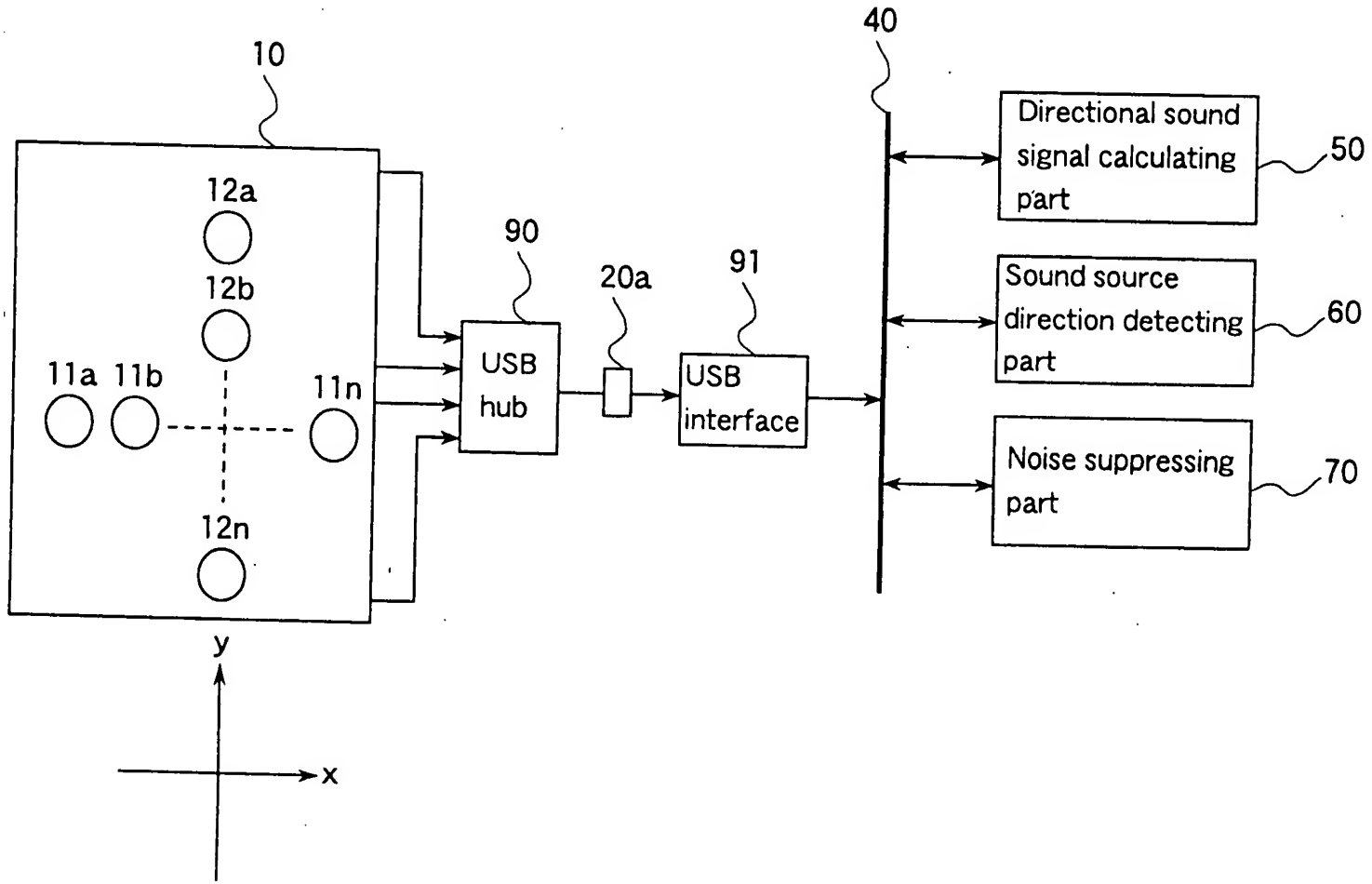

10
12a
12b
11a
11b
11n
12n
y
x
90
USB hub
20a
91
USB interface
40
Directional sound signal calculating part
50
Sound source direction detecting part
60
Noise suppressing part
70

FIG. 2

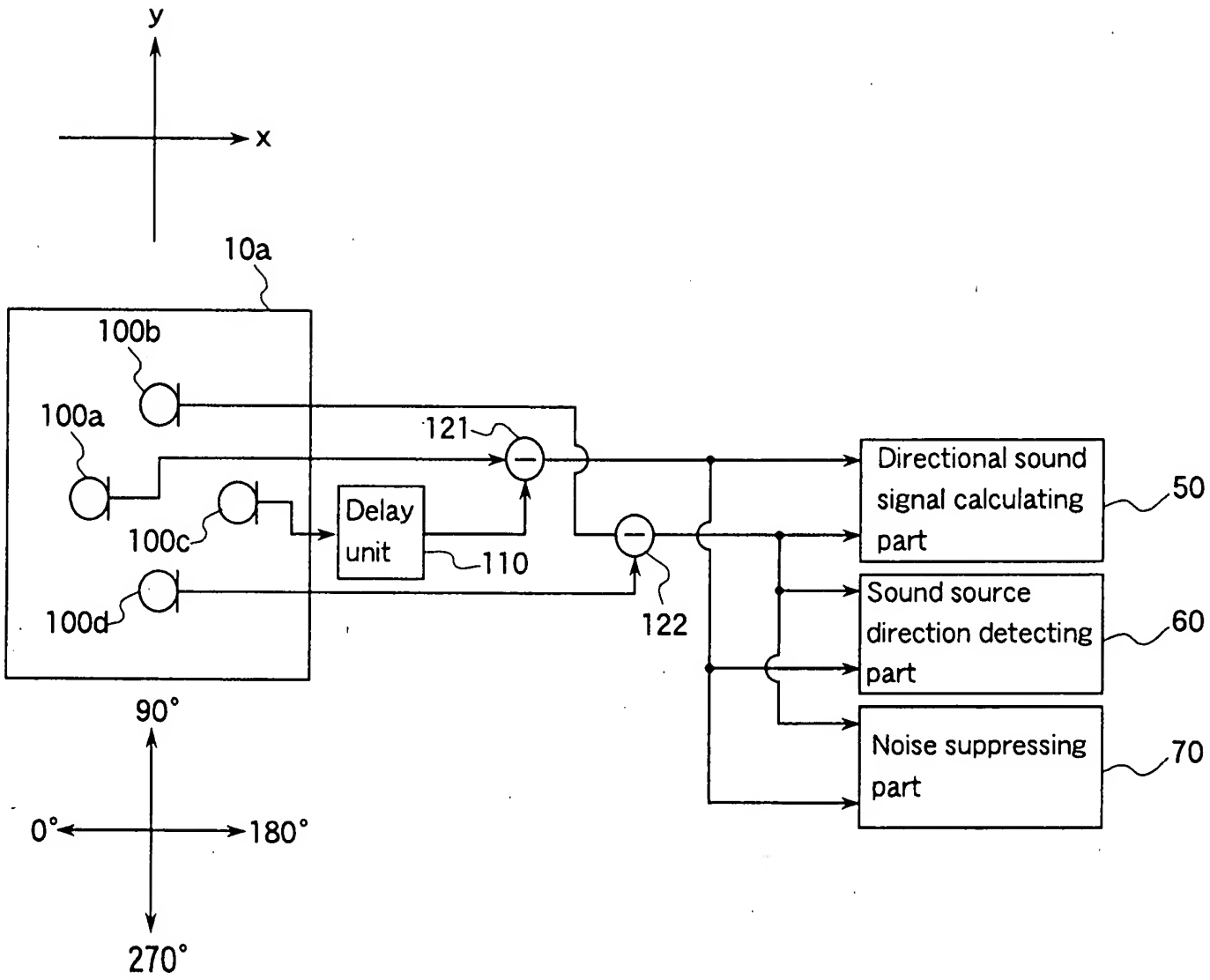

y
x
10a
100b
100a
100c
100d
121
Delay unit
110
122
Directional sound signal calculating part
50
Sound source direction detecting part
60
Noise suppressing part
70
90°
0°
180°
270°

FIG. 3

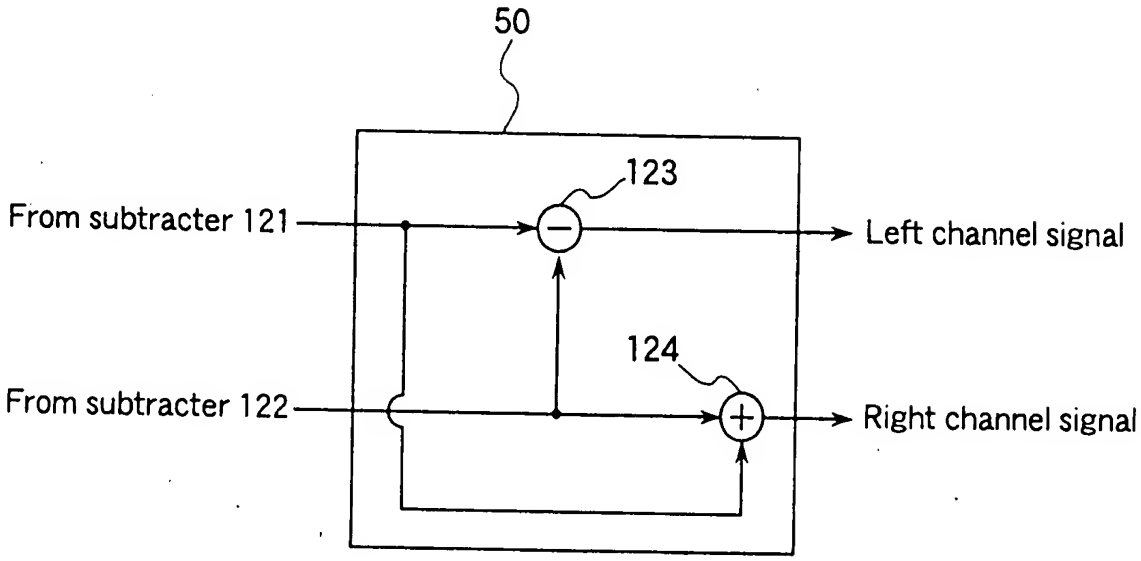

50
123
From subtracter 121
Left channel signal
124
From subtracter 122
Right channel signal

FIG. 4

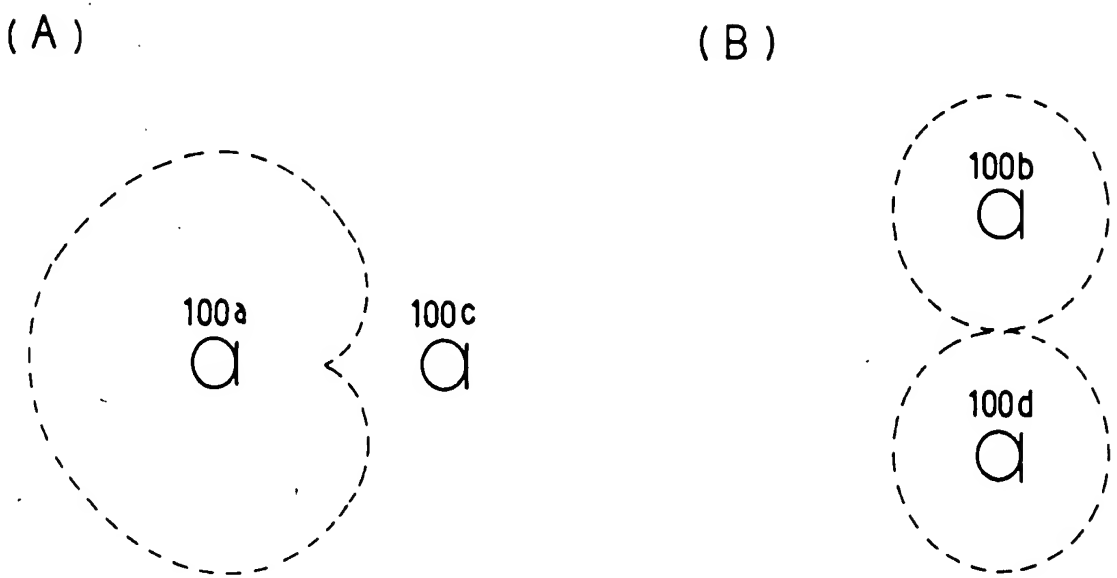
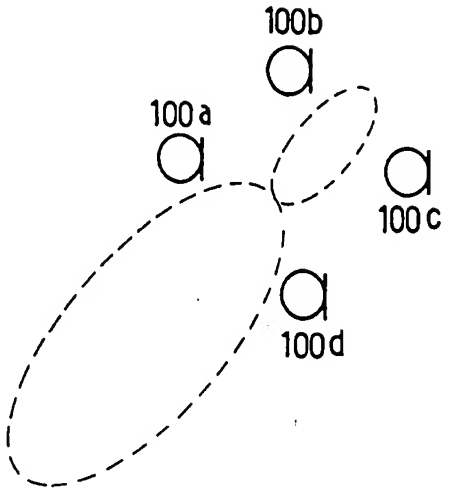


FIG. 5

(A)



(B)

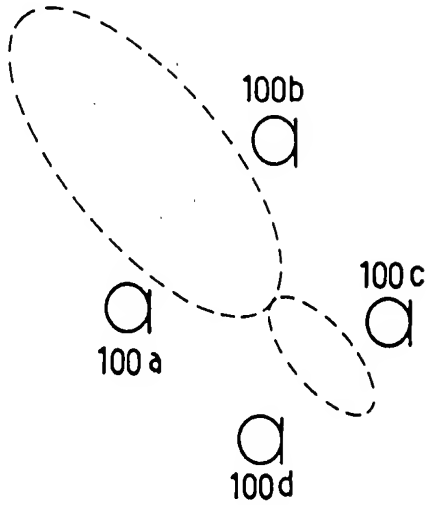


FIG. 6

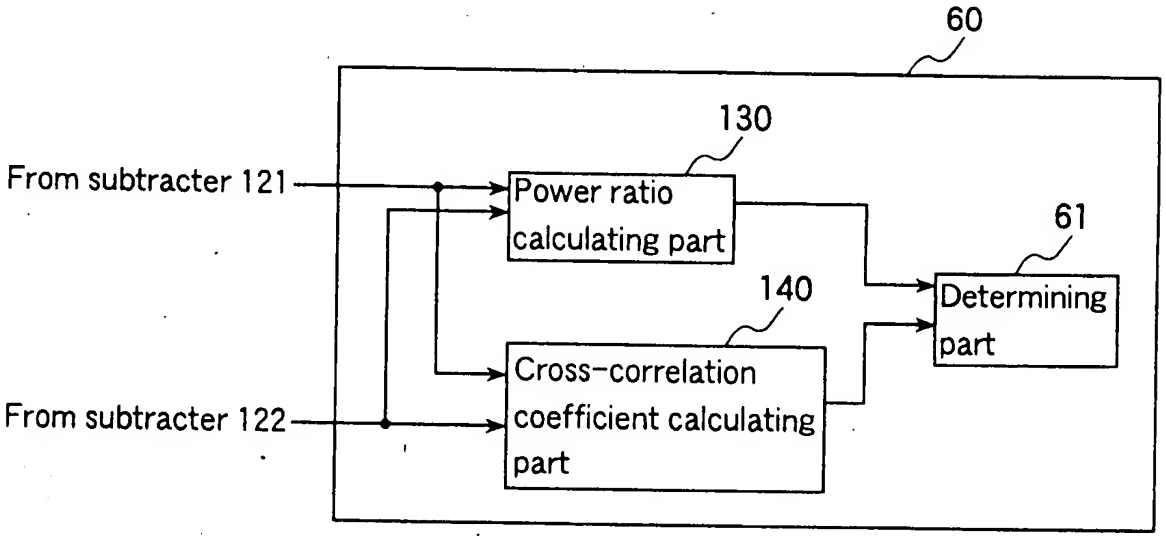

60
130
From subtracter 121
Power ratio calculating part
61
Determining part
140
Cross-correlation coefficient calculating part
From subtracter 122

FIG. 7

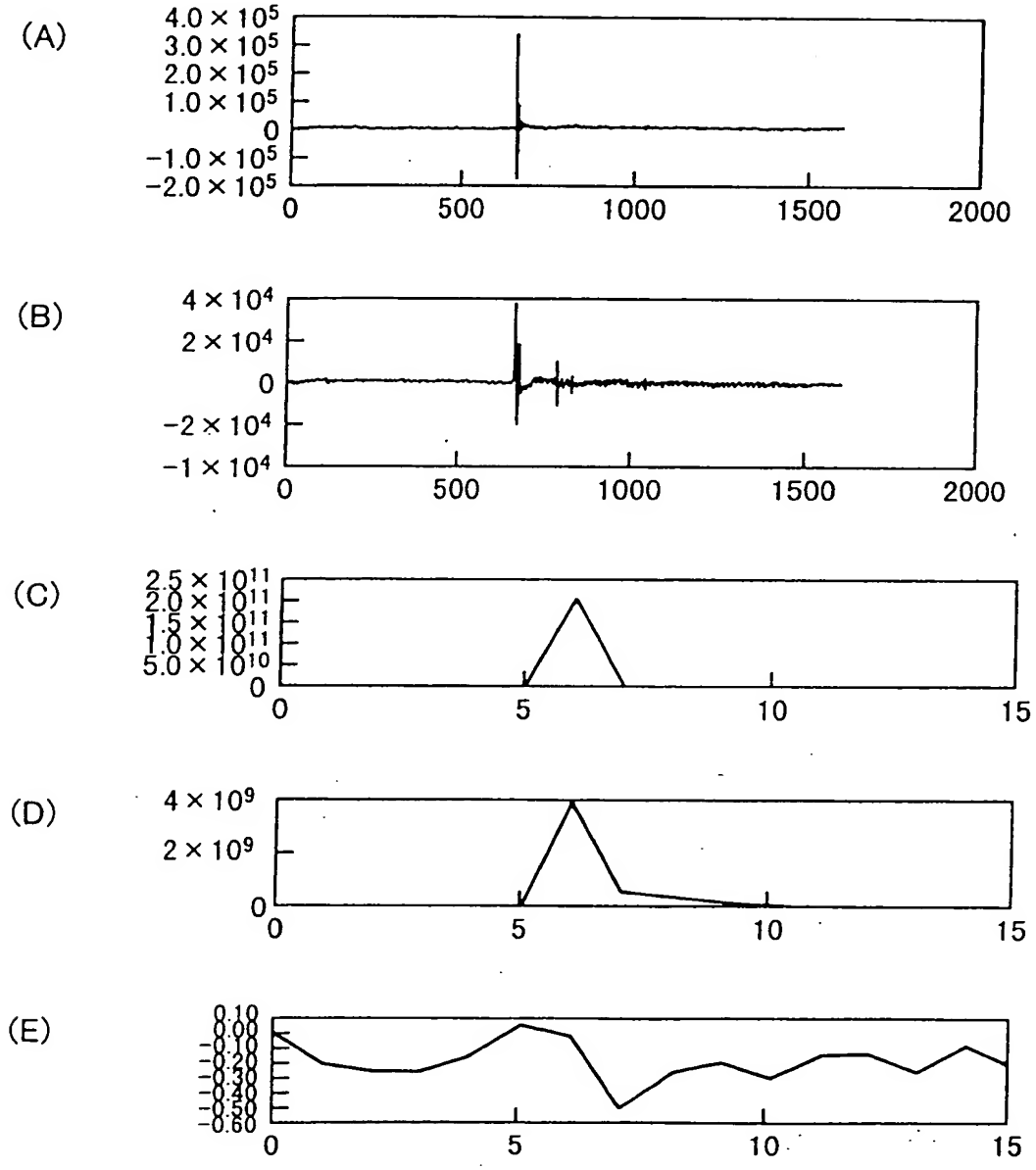

(A)
4.0 × 10^5
3.0 × 10^5
2.0 × 10^5
1.0 × 10^5
0
−1.0 × 10^5
−2.0 × 10^5
0
500
1000
1500
2000
(B)
4 × 10^4
2 × 10^4
0
−2 × 10^4
−1 × 10^4
0
500
1000
1500
2000
(C)
2.5 × 10^11
2.0 × 10^11
1.5 × 10^11
1.0 × 10^11
5.0 × 10^10
0
0
5
10
15
(D)
4 × 10^9
2 × 10^9
0
0
5
10
15
(E)
0.10
0.00
−0.10
−0.20
−0.30
−0.40
−0.50
−0.60
0
5
10
15

FIG. 8

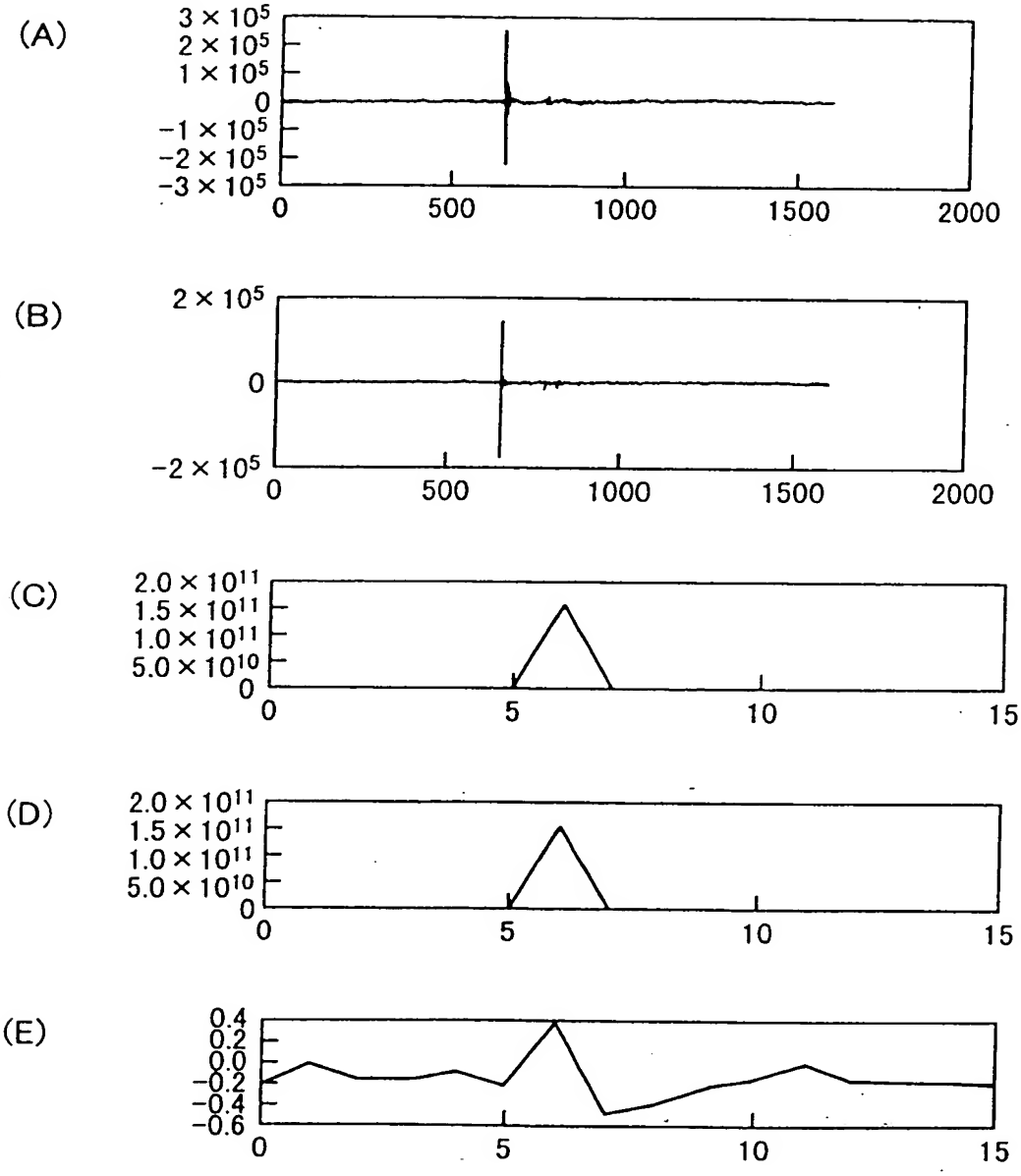

(A)
3 × 10^5
2 × 10^5
1 × 10^5
0
−1 × 10^5
−2 × 10^5
−3 × 10^5
0
500
1000
1500
2000
(B)
2 × 10^5
0
−2 × 10^5
0
500
1000
1500
2000
(C)
2.0 × 10^11
1.5 × 10^11
1.0 × 10^11
5.0 × 10^10
0
0
5
10
15
(D)
2.0 × 10^11
1.5 × 10^11
1.0 × 10^11
5.0 × 10^10
0
0
5
10
15
(E)
0.4
0.2
0.0
−0.2
−0.4
−0.6
0
5
10
15

FIG. 9

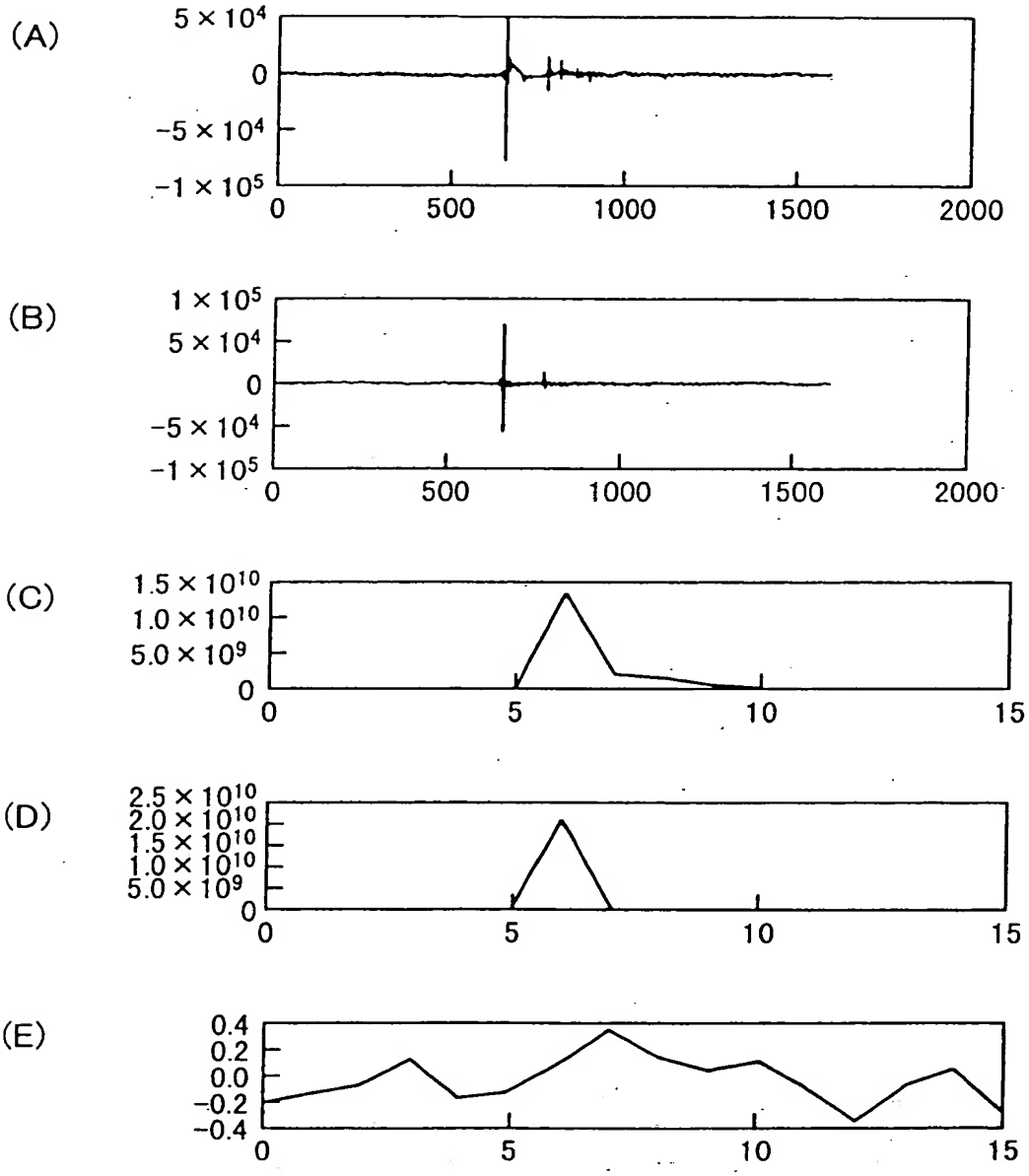

(A)
5 × 10^4
0
−5 × 10^4
−1 × 10^5
0
500
1000
1500
2000
(B)
1 × 10^5
5 × 10^4
0
−5 × 10^4
−1 × 10^5
0
500
1000
1500
2000
(C)
1.5 × 10^10
1.0 × 10^10
5.0 × 10^9
0
0
5
10
15
(D)
2.5 × 10^10
2.0 × 10^10
1.5 × 10^10
1.0 × 10^10
5.0 × 10^9
0
0
5
10
15
(E)
0.4
0.2
0.0
−0.2
−0.4
0
5
10
15

FIG. 10

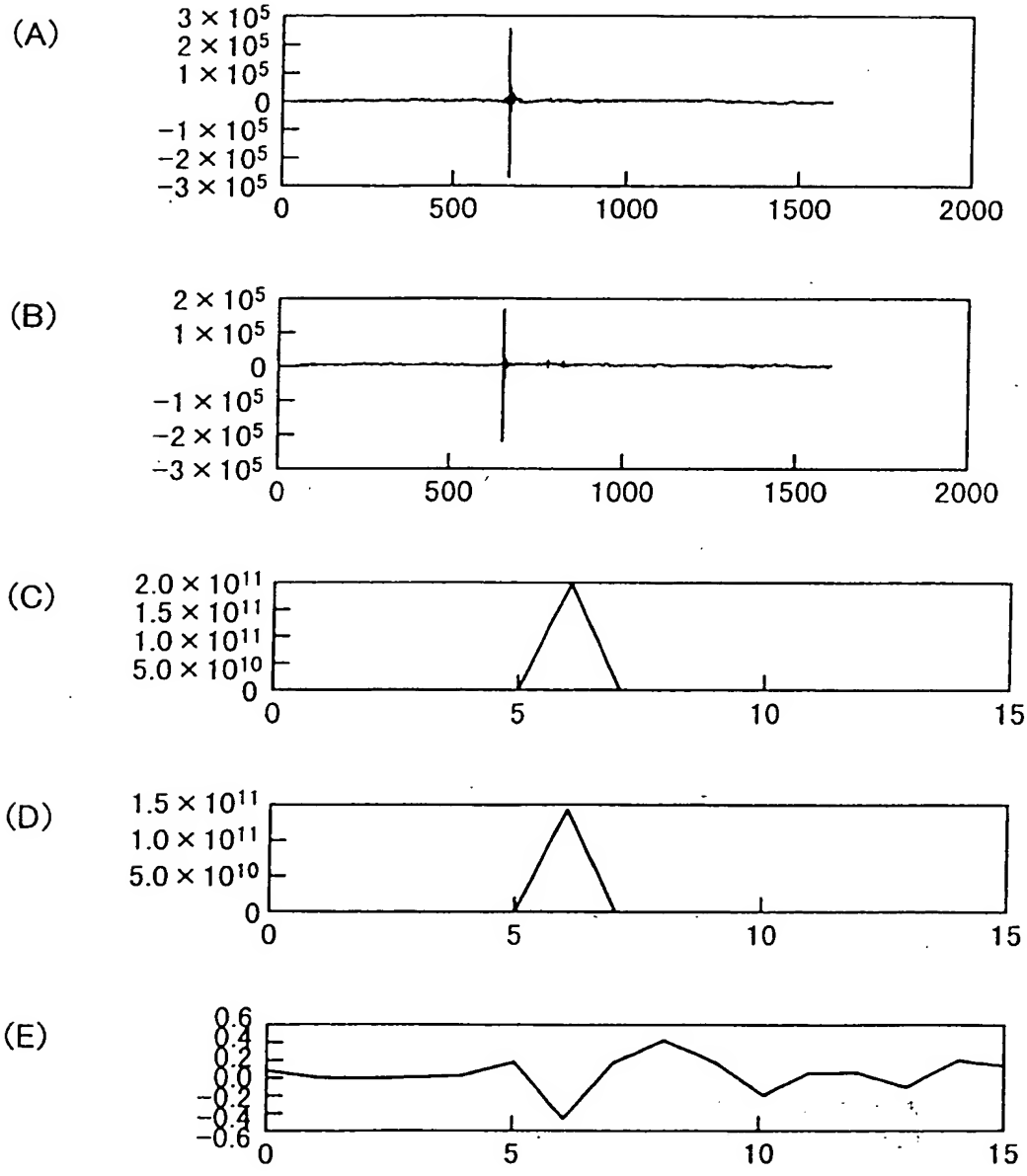

(A)
3 × 10^5
2 × 10^5
1 × 10^5
0
−1 × 10^5
−2 × 10^5
−3 × 10^5
0
500
1000
1500
2000
(B)
2 × 10^5
1 × 10^5
0
−1 × 10^5
−2 × 10^5
−3 × 10^5
0
500
1000
1500
2000
(C)
2.0 × 10^11
1.5 × 10^11
1.0 × 10^11
5.0 × 10^10
0
0
5
10
15
(D)
1.5 × 10^11
1.0 × 10^11
5.0 × 10^10
0
0
5
10
15
(E)
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
0
5
10
15

FIG. 11

	$\frac{\text{Bidirectional microphone input signal power}}{\text{Unidirectional microphone input signal power}}=(P)$	Cross-correlation coefficient (R)
0°	$P<T_P$	$T_{R1}<R\leqq T_{R2}$
90°	$P\geqq T_P$	$R>T_{R2}$
180°	$P\geqq T_P$	$T_{R1}<R\leqq T_{R2}$
270°	$P\geqq T_P$	$R\leqq T_{R1}$

FIG . 12

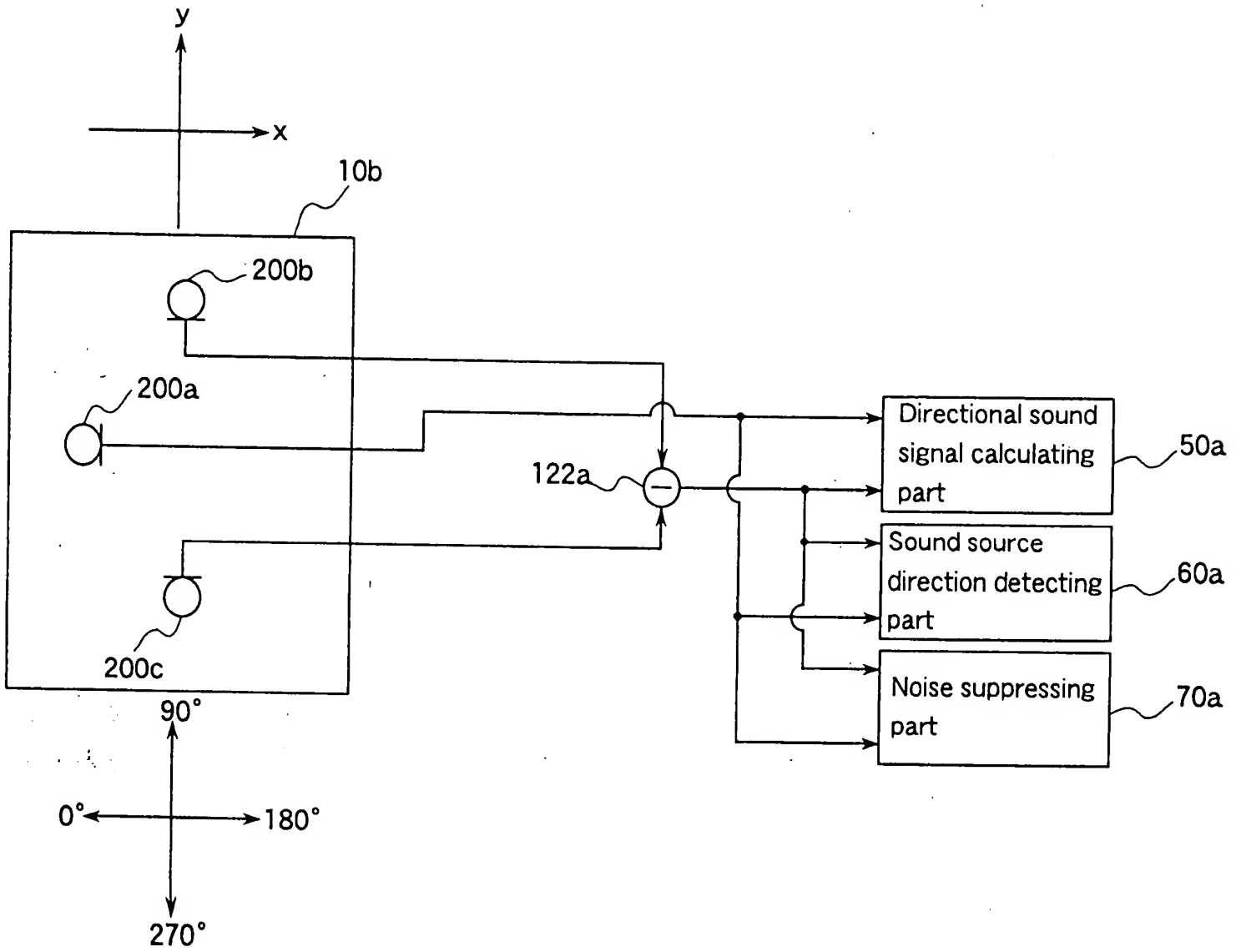

y
x
10b
200b
200a
200c
122a
Directional sound signal calculating part
50a
Sound source direction detecting part
60a
Noise suppressing part
70a
90°
0°
180°
270°

FIG. 13

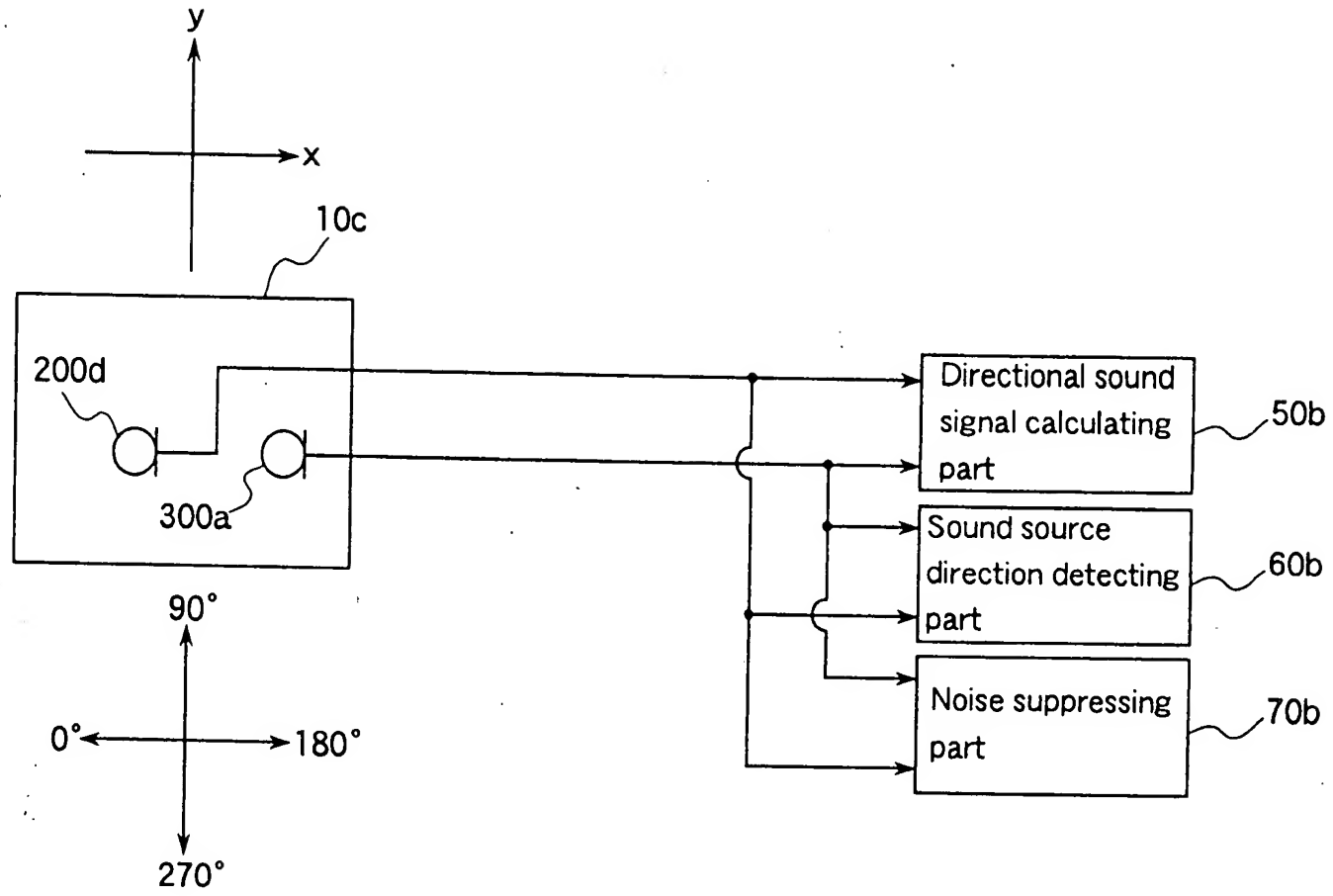

y
x
10c
200d
300a
90°
0°
180°
270°
Directional sound signal calculating part
50b
Sound source direction detecting part
60b
Noise suppressing part
70b

FIG. 14

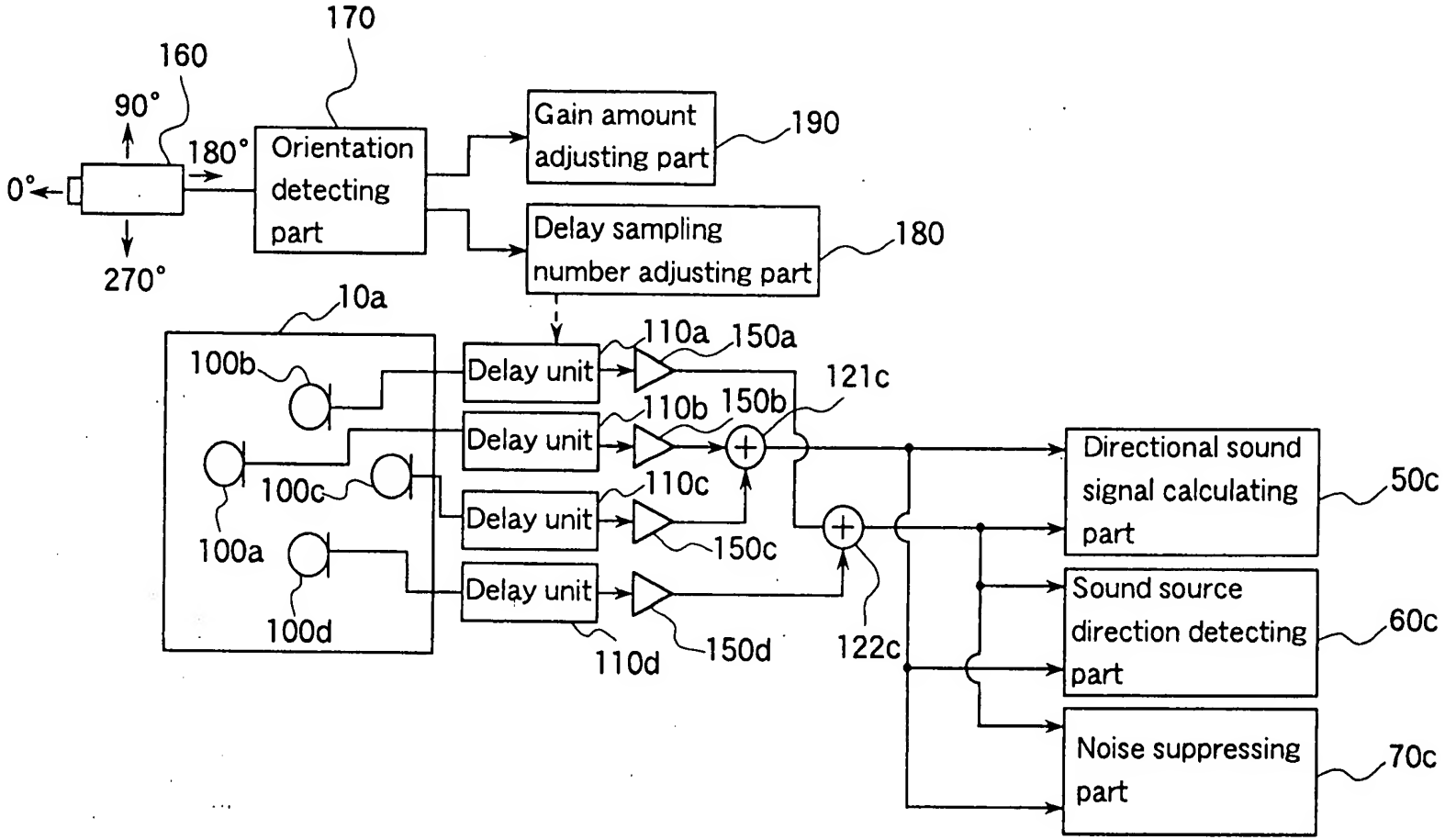

170
160
90°
180°
0°
270°
Orientation detecting part
Gain amount adjusting part
190
Delay sampling number adjusting part
180
10a
100b
100c
100a
100d
Delay unit
Delay unit
Delay unit
Delay unit
110a
150a
110b
150b
110c
150c
110d
150d
121c
122c
Directional sound signal calculating part
50c
Sound source direction detecting part
60c
Noise suppressing part
70c

FIG. 15

Orientation of a camera 160	The delay sampling number	The amount of gain adjustment
0°	Delay unit 110c:1 Delay unit 110a,b,d:0	150a,b,e,g,h:+1.0 150c,d,f:−1.0
90°	Delay unit 110d:1 Delay unit 110a,b,c:0	150b,c,f,g,h:+1.0 150a,d,e:−1.0
180°	Delay unit 110a:1 Delay unit 110b,c,d:0	150c,d,e,g,h:+1.0 150a,b,f:−1.0
270°	Delay unit 110b:1 Delay unit 110a,c,d:0	150a,d,f,g,h:+1.0 150b,c,e:−1.0

FIG . 16

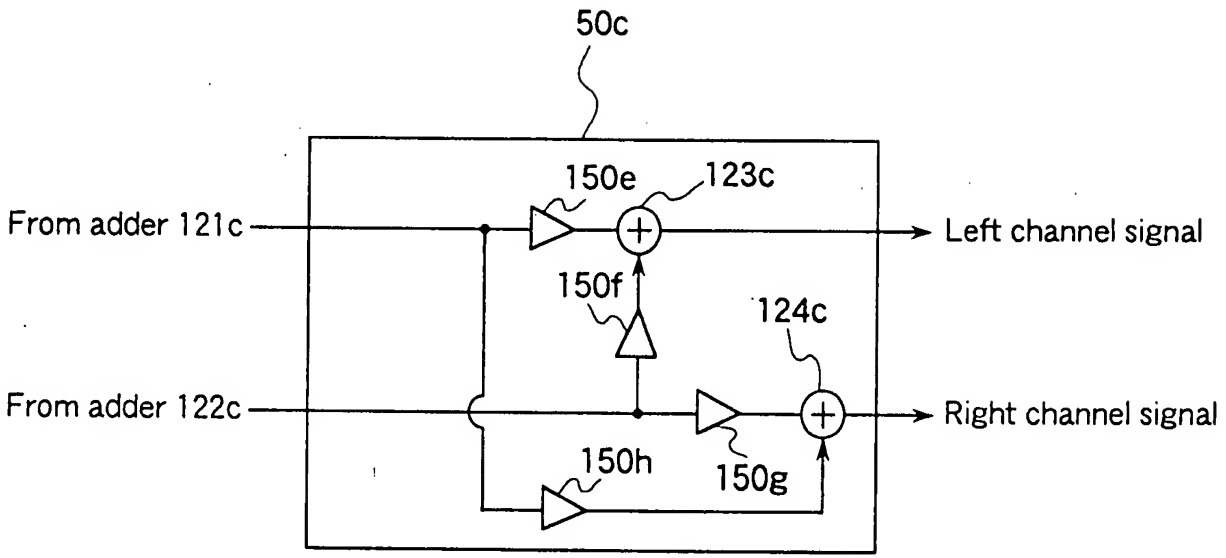

50c
150e
123c
From adder 121c
Left channel signal
150f
124c
From adder 122c
Right channel signal
150h
150g

FIG. 17

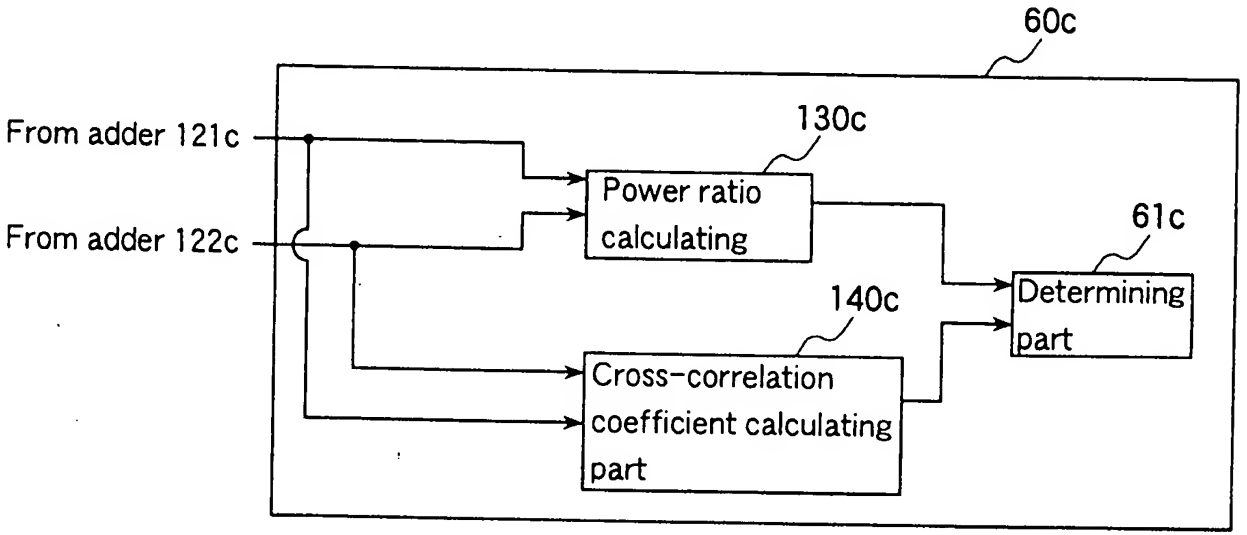

60c
From adder 121c
From adder 122c
130c
Power ratio calculating
61c
Determining part
140c
Cross-correlation coefficient calculating part

FIG. 18

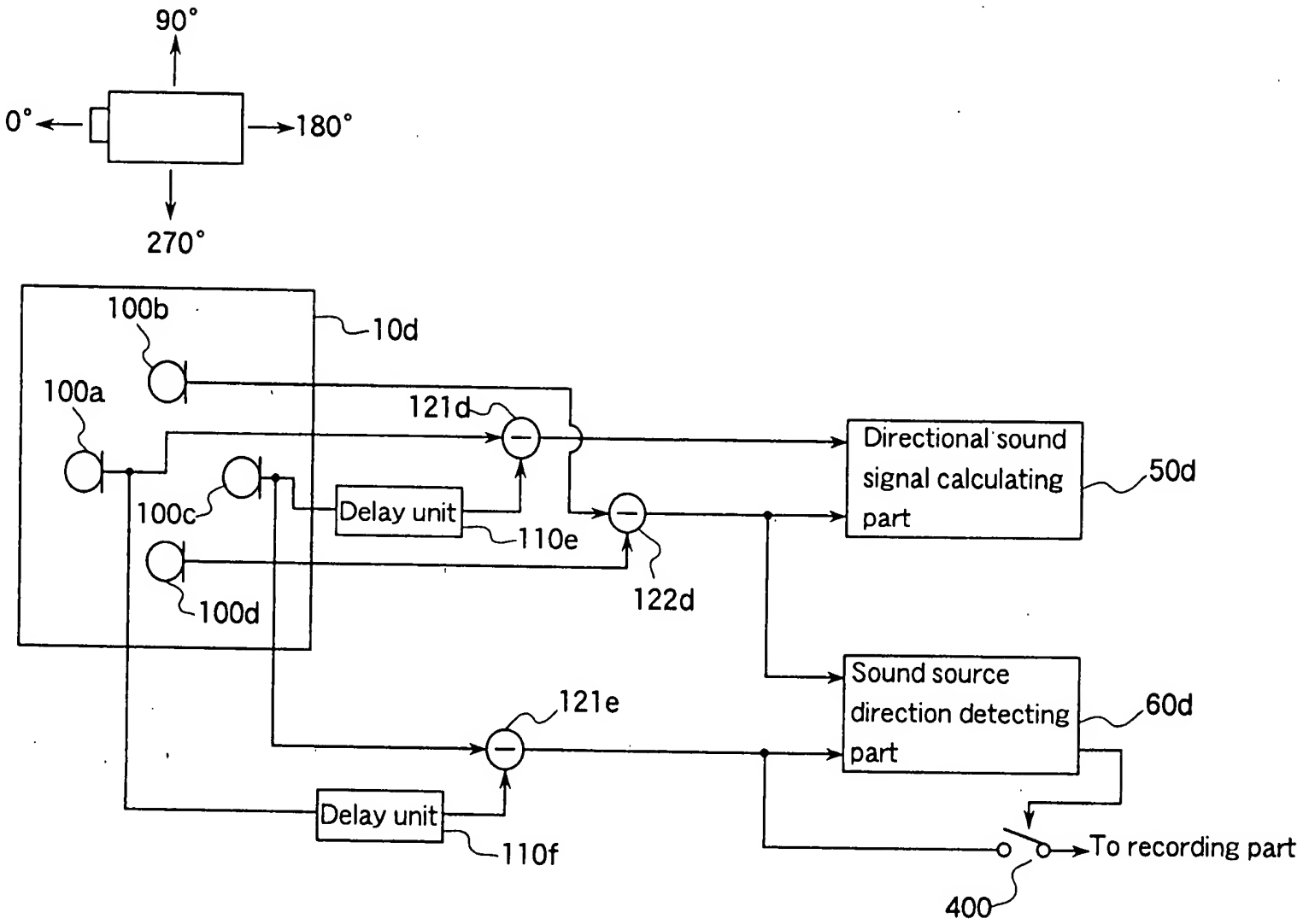

90°
0°
180°
270°
100b
10d
100a
121d
Directional sound signal calculating part
50d
100c
Delay unit
110e
122d
100d
Sound source direction detecting part
60d
121e
Delay unit
110f
To recording part
400

FIG. 19